High Quality Silicon-Based Substrates for Microwave and Millimeter wave Passive circuits

Y. Belaroussi, M. Rack, A.A. Saadi, G. Scheen, M.T. Belaroussi, M. Trabelsi, J.P. Raskin

PII: S0038-1101(17)30229-0
DOI: http://dx.doi.org/10.1016/j.sse.2017.06.028
Reference: SSE 7265

To appear in: *Solid-State Electronics*

Received Date: 21 March 2017
Revised Date: 21 June 2017
Accepted Date: 22 June 2017

Please cite this article as: Belaroussi, Y., Rack, M., Saadi, A.A., Scheen, G., Belaroussi, M.T., Trabelsi, M., Raskin, J.P., High Quality Silicon-Based Substrates for Microwave and Millimeter wave Passive circuits, *Solid-State Electronics* (2017), doi: http://dx.doi.org/10.1016/j.sse.2017.06.028

High Quality Silicon-Based Substrates for Microwave and Millimeter wave Passive circuits

Y. BELAROUSSI[1, 2]*, M. RACK[3], A. A. SAADI[2], G. SCHEEN[3], M. T. BELAROUSSI[2], M. TRABELSI[1] and J. -P. RASKIN[3]

[1]Ecole Nationale Polytechnique, Algiers, Algeria
[2]Microelectronics and Nanotechnology Division, Centre de Développement des Technologies Avancées (CDTA), 20 Août 1956, Baba Hassen, BP: 17, Algiers 16303, Algeria
[3]Institute of Information and Communication Technologies, Electronics and Applied Mathematics (ICTEAM), Université catholique de Louvain (UCL), Place du Levant, 3, Maxwell Building, bte L5.03.02, B-1348 Louvain-la-Neuve, Belgium

Abstract

Porous silicon substrate is very promising for next generation wireless communication requiring the avoidance of high-frequency losses originating from the bulk silicon. In this work, new variants of porous silicon (PSi) substrates have been introduced. Through an experimental RF performance, the proposed PSi substrates have been compared with different silicon-based substrates, namely, standard silicon (Std), trap-rich (TR) and high resistivity (HR). All of the mentioned substrates have been fabricated where identical samples of CPW lines have been integrated on. The new PSi substrates have shown successful reduction in the substrate's effective relative permittivity to values as low as 3.7 and great increase in the substrate's effective resistivity to values higher than 7 kΩ cm. As a concept proof, a mm-wave bandpass filter (MBPF) centred at 27 GHz has been integrated on the investigated substrates. Compared with the conventional MBPF implemented on standard silicon-based substrates, the measured S-parameters of the PSi-based MBPF have shown high filtering performance, such as a reduction in insertion loss and an enhancement of the filter selectivity, with the joy of having the same filter performance by varying the temperature. Therefore, the efficiency of the proposed PSi substrates has been well highlighted.

Keywords- Bandpass filter (BPF); high temperature; millimeter-wave; minimum insertion loss; porous silicon (PSi).